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IR/UV Study of Jupiter's Impact-Perturbed Stratosphere and Aurora

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In pursuit of the uniform reduction, analysis, and presentation of IUE data on Jupiter acquired during the Shoemaker-Levy 9 (SL9) impact period, we have developed software to load an IDL data structure with information from the standard IUE NEWSIPS data products and combine it with additional information specific to the observational circumstances loaded from auxiliary data files. Corresponding software has been prepared in a draft version to write the auxiliary information to disk in order to store physical ephemeris information and reduced data (e.g., improved camera backgrounds, results of statistical noise analysis). These tools will be used by Co-Investigators T.A. Livengood and S.A. Budzien in the preparation of electronic publication of the data in a form suitable for distribution to non-specialist scientists. To pursue the compilation of the IUE SL9 data set (and follow-up observations) from both US and VILSPA observations, we also developed procedures to convert FITS files stored in the VILSPA data-distribution format to standard named files on local computers.

We have developed an algorithm to remove the residual camera background from the NEWSIPS-processed spectral images in order to preserve with maximal accuracy the spectral and spatial information in the spatially-resolved spectrum, as part of the creation of a comprehensive analytical package for the SL9 data. The standard tools found in the IUEDAC installation were found to be less effective for our specialized needs, although the actual tools developed for this task will be generally applicable to other IUE spectra. The full implementation of the background-removal algorithm will be performed in later work.

In the development of these software tools, we investigated the application of the standard NEWSIPS noise model for IUE data in the analysis of planetary and solar system spectra. This work required the conversion of the original FORTRAN scalar code to an efficiently-coded vector scheme in IDL. We have determined that the NEWSIPS noise model is insufficient for the accurate statistical analysis of rich molecular spectra of extended sources, as well as being ineffective in interpreting the statistical noise associated with summing or comparing IUE spatial orders. With Co-I's Livengood and Budzien, we have therefore developed an alternative algorithm for noise analysis based directly on statistical fluctuations of the camera-background regions within the individual IUE spectral images under examination. This algorithm requires special attention to the statistical properties of the processing steps in the data analysis, although it is not specific to the present task. The full implementation of the statistical analysis will be part of later work.